Af/16/4.

1936.

PALESTINE GOVERNMENT.

Report on Peat Soil from Tulkarem Sub District.

No. AG/13/20.

DEPARTMENT OF AGRICULTURE
AND FORESTS,

JERUSALEM.

2nd January, 1936.

Agricultural Officer,
Northern District, Haifa.

Agricultural Officer,
Southern District, Jaffa.

Agricultural Officer,
Jerusalem District, Jerusalem.

Subject:- Report on Peat Soil from Tulkarm. Sub-District.

I enclose, for your information, copy of a letter No. M. 5394 of 7/11/35 received from the Imperial Institute, London, together with the enclosure thereto - a report on the peat soil from Birket Ramadan, which was forwarded to that Institute for trial.

CHIEF AGRICULTURAL OFFICER.

RA.

1635

(copy)

Ref. No. M. 5394.

Imperial Institute,
South Kensington,
London, S.W.7.

7th November, 1935.

Sir,

I have pleasure in sending you a report on the samples of peat soil from Tulkarm Sub-District, Palestine, to which you referred in your letter DC/226/34-474 of 1st August.

In accordance with his request, a copy of this report is being sent to Mr. G.W. Baker.

I am, Sir,
Your obedient servant,

Sgd. Thos. Crook

Principal,
Mineral Resources Department.

The Development Officer,
Department of Development,
P.O.Box 649,
Jerusalem,
Palestine.

Ref.No. M.5394.

IMPERIAL INSTITUTE
SOUTH KENGINSTON,
LONDON, S.W.7.

REPORT ON PEATS FROM PALESTINE.

The three samples of peat which form the subject of this report were forwarded to the Imperial Institute by the Development Officer, Palestine, and are referred to in his letter No. DC/226/34-474 of the 1st August, 1935. The samples were forwarded through Mr. G.W. Baker, Government Analyst, Palestine, and it was stated that an opinion was desired regarding the value of the peat as compared with commercial peat for fuel and as peat moss litter, and also on its cultural value. In a subsequent interview at the Imperial Institute, Mr. Baker stated that in view of the lack of organic matter in Palestine soils, any suggestions regarding the possible use of the material for agricultural purposes would be valuable.

Description of Samples.

No. 1. Surface. Weight 2 lb. A dark, almost black, fibrous mass, very irregular in appearance, containing a large amount of roots and woody material; rather difficult to break up.

No. 2. 40 cm. below surface. Weight 1 lb.8 oz. A dark, somewhat fibrous mass, more compact than the surface sample, but still irregular and containing woody material.

No. 3. 1m. below surface. Weight 1 lb.12 oz. No definite structure visible, very hard and compact, but varying in hardness and colour: very difficult to break up.

Results of Examination.

A representative portion of each sample was put through a distintegrator in order to obtain small homogeneous samples for analysis.

REPORT ON PEAT FUEL SAMPLES.

The three samples of peat which form the subject of this report were forwarded to the Imperial Institute by the Government Officer, Malaytia, and are referred to in his letter No. 4/Ass/24-27 of the 1st August, 1924. The samples were forwarded through H. E. the Governor, Straits Settlements, and it was stated that a public was desired regarding the value of the peat as compared with commercial peat and as peat possibly suitable for use in the cotton mills. In a conversation interview at the Imperial Institute, Mr. Baker stated that in view of the low or organic matter in relative scale, any suggestions regarding the development of the material for agricultural purposes would be valueless.

Description of samples.

No. 1. Hard, compact, dark, almost black, fibrous mass, very irregular in appearance, containing a very amount of wood and woody material rather difficult to break up.

No. 2. Two cm. below surface. Weight 1.5 lb. 2 oz. Darker, more fibrous mass, more compact than the sample, but still irregular and containing woody material.

No. 3. 1.1 below surface. Weight 1 lb. 12 oz. Definite structure visible, very hard and compact, varying in darkness and colour, very difficult to break up.

Details of examination.

A representative portion of each sample was air-dried through a distillation in order to obtain small homogeneous samples for analysis.

The results of examination may be conveniently grouped under three headings :-

(1) Value as peat fuel.

(2) Value as peat moss litter.

(3) Possible agricultural utilisation.

(1) Value as peat fuel. Partial analysis and determinations of the calorific values of the peats were made on each sample with the following results :-

	No. 1 Surface.	No. 2. 40 cm. below surface.	No. 3. 1 metre below surface.
Ash (per cent).	34.62	19.58	20.74
Moisture (per cent).	14.86	17.08	25.45
Calorific value (in small calories).	2,280	2,860	2,730

The materials, when heated by a gas flame, smoked vigorously, but did not hold fire by themselves and would not continue even to smoulder when the external source of heat was removed.

The moisture present in the samples as received is not high for air-dried peat, but the calorific value is extremely low. Brame ("Fuel", London, 1914) states that for air-dried peat, containing 25 per cent of moisture, the average calorific value is about 3,450 calories. Other samples of peat examined at the Imperial Institute have shown calorific values ranging from about 4,000 to 4,700 calories.

(2) Value as peat moss litter. In comparison with commercial samples of peat moss litter as sold in this country, the present samples would be considered of very poor quality. The material represented by the samples from the surface and at 40 cm. below surface, however, although rather fibrous and woody, and with a tendency to be somewhat dusty, might, after being disintegrated, find a local use for this purpose. The

The results of analysis may be conveniently grouped under three headings :-

(1) Value as peat fuel.

(2) Value as peat moss litter.

(3) Possible agricultural utilisation.

(1) Value as peat fuel. Partial analyses and determinations of the calorific values of the gases were made on each sample with the following results :-

	No. 1. Tarbrae.	No. 2. Ho Gill Moss.	No. 3. Lybster Peat Moss.
Ash (per cent).	6.85	10.00	20.74
Moisture (per cent).	14.60	17.00	24.48
Calorific value in small calories.	[illegible]	[illegible]	5,030

The material, when heated by a gas flame, smoked vigorously, but did not hold fire by itself and would not continue even to burn when the external source of heat was removed.

(2) Suitability for the samples as peat moss litter is not high for several reasons, but the calorific value is strongly low. Dried peat moss litter, only stores well for a reasonable period, maintaining its dry condition. The average calorific value is about 8,000 calories. Other samples at least examined at the Imperial Institute have shown calorific values ranging from about 6,000 to 6,500 calories.

(3) Possible agricultural utilisation. In comparison with commercial samples of peat moss litter, as sold in this country, the present samples would be distinctly of very poor quality. The material represented by the samples from the surface of the bogs, below surface, however, although rather fibrous and woody, yet with a tendency to be somewhat sandy, might, after further examination, find a local use for this purpose.

third sample, from 1 metre depth, does not appear to be suitable for use as litter.

(3) Possible agricultural utilisation. The amounts of soluble salts present in the peats, as well as their nitrogen and organic carbon contents and reaction, are of importance in this connection and these determinations were accordingly made, with the following results :-

		No. 1 Surface Per Cent.	No. 2 40 cm. Per Cent.	No. 3 1 metre Per Cent.
Total Nitrogen.	N	1.10	1.41	2.31
Organic Carbon.	C	25.3	34.8	29.2
Soluble Salts.				
Chlorine.	Cl	0.13	0.12	0.14
Sulphuric anhydride	SO_3	0.07	0.04	0.31
Lime.	CaO	0.09	0.05	0.15
Magnesia.	MgO	0.04	0.02	0.05
Potash.	K_2O	0.05	0.04	0.04
Soda.	Na_2O	0.12	0.11	0.14
Silica.	SiO_2	0.02	Nil	Nil
Ferric Oxide.	Fe_2O_3)			
Alumina.	Al_2O_3)	0.02	0.02	0.03

The above radicals may be calculated to the following hypothetical combinations :-

Potassium chloride	KCl	0.08	0.06	0.06
Sodium chloride	NaCl	0.15	0.15	0.18
Sodium Sulphate.	Na_2SO_4	0.09	0.06	0.09
Calcium sulphate	$CaSO_4$	0.03	0.02	0.26
Magnesium sulphate	$MgSO_4$	-	-	0.20
Lime (in excess of that required for calcium sulphate) x.	CaO	0.07	0.04	-
Magnesia (in excess of that required for magnesium sulphate) x	MgO	0.04	0.02	-
Total.		0.46	0.35	0.79

x. Probably present in combination with organic matter.

The reaction of the water extract was in each case faintly acid, the pH values being as follows :-

Surface.	6.5
40 cm. depth.	6.6
1m. depth.	6.4

water shall, from water depth, does not appear to be suitable for use as litter.

(5) Possible agricultural utilisation. The amounts of soluble salts present in the peats, as well as their nitrogen and organic carbon contents and reaction, are of importance in this connection and these determinations were accordingly made, with the following results:-

	No. 1. Surface. Per cent.	No. 2. 4 ft. Per cent.	No. 3. 1 metre 5 cm. Per cent.
Total Nitrogen.	1.16	1.41	0.81
Organic Carbon.	36.5	44.8	32.2
Soluble Salts.			
Chlorine.	0.15	0.12	0.16
Sulphuric anhydride SO_3	0.37	0.26	0.21
Lime. CaO	0.09	0.05	0.18
Magnesia. MgO	0.05	0.03	0.08
Potash. K_2O	0.08	0.06	.08
Soda. Na_2O	0.12	0.11	.16
Silica. SiO_2	0.02	Nil	Nil
Ferric oxide. Fe_2O_3			
Alumina. Al_2O_3	.12	.08	0.03

The above constituents may be calculated to the following hypothetical combinations:-

Potassium chloride KCl	0.08	0.06	0.06
Sodium chloride. NaCl	0.12	0.15	.18
Sodium sulphate. Na_2SO_4	0.09	.06	.8
Calcium sulphate $CaSO_4$	.03	0.05	0.3
Magnesium sulphate $MgSO_4$	-	-	0.20
(In excess of that required for sulphate)			
Magnesia (in excess of that required for sulphate)	0.07	0.04	-
Total.	0.46	0.38	.72

Nitrogen probably present in combination with organic matter.

The reaction of the water extract was in each case faintly acid, the pH values being as follows:-

Surface.	6.8
4 ft. depth.	5.5
1m. depth.	5.4

The material represented by these three samples of peat might be used for supplying organic matter and some nitrogen to soils deficient in these constituents. The amount of nitrogen added, however, would be small and the chief value of the peats would lie in the provision of organic matter. The amounts of soluble salts present in all three peat samples would be regarded as high for a normal soil, but the percentages of the salts added to the soil by the incorporation of relatively small amounts of peat would probably not be excessive. In the case of the peat sample from one metre depth, a considerable proportion of the total soluble salts consists of sulphates, which are less harmful to crops than chlorides. In any case, a mixture of soluble salts is known to be less toxic to plants than the same quantities of salts applied singly, and in these peats the salts are of a somewhat complex nature. Some care would, however, have to be taken in the continued application of these peats, to prevent the accumulation of excessive amounts of soluble salts in the soils with which they were incorporated, but adequate drainage, if practicable, would probably be sufficient for this purpose.

The actual use of peat land for cultivation presents a different and a difficult problem. In the present case, the physical difficulties caused by the differences in composition of the top- and sub-layers of peat are very considerable. The upper layers are too fibrous and irregular to allow cultivation by plough or other implements and the sub-soil layer at one metre deep is very hard and impervious. One of the first essentials in the reclamation of peat land is adequate drainage, but the character of the sub-soil in the present case would appear to make this very difficult.

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application of these peats, to prevent the accumulation of
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may come injurious, but some more drainage. It probably
would generally be advisable for this purpose.

The actual use of peat land for cultivation
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in Ontario drainage, but the character of the sub-soil
in the present case would appear to make this very difficult.

Another requirement, with acid peat land, is the application of lime and other manures, usually of an artificial nature. In the present case, potash would not be needed, as it appears to be present in adequate amounts, but phosphates would most probably be required.

It has been found possible, in Scotland and in various parts of Europe, to reclaim peat land, and accounts of this work are given by Ogg ("Reclamation of Peat Land in Northern Europe", Scottish Jour. Agric. 1929, 12, 5. "Reclamation and Cultivation of Peat Land in Lewis", Part I, by Ogg and Macleod, ibid. 1930, 13, 121, and Part II, by Ogg, Garst and Macleod, ibid. 1931, 14, 1931). In all cases, the improvement of peat land has been found to be a slow process and usually somewhat costly, owing to the necessity for artificial drainage and often for the application of large quantities of artificial fertilisers, as well as the need of special machinery for cultivation. In the present case, these difficulties would be increased by the impervious character of the sub-soil and by the presence of undesirable quantities of soluble salts, which increase with depth.

Conclusions.

It appears that these samples of peat are unsuitable for fuel. The samples from the surface and at a depth of 40 cm. might find local application as peat moss litter and all of them might be useful locally for supplying humus and very small quantities of nitrogen to soils needing these substances.

The prospects of successfully carrying out actual cultivation of the peaty area itself do not appear very hopeful.

7th November, 1935.